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The attributions of indeterminism, anthropomorphism, etc., have their source in his mistaken statement that the idea of reactions to variations in environmental conditions had escaped me; in his book he places them on that basis. With the demonstration of his mistake on that point they fall to the ground. Let us put the matter clearly once for all. Either Bohn can or he can not cite passages from my work which justify his assertions and implications that I deny determinism and that I give anthropomorphic and non-objective explanations in place of causal ones. He has not as yet made, either in his book or his numberless papers, any attempt to give such citations. If he can do so, it would be worth while, that we may see on what basis he is proceeding. If he can not, to continue to make such statements is unscientific, for they are not verifiable.

Alas! then, we find that our author does not stand the test that we hoped might set at rest the doubts as to the accuracy and trustworthiness of his scientific results in difficult fields. I have not attempted to test the remainder of his account, but I fear that similar qualities might be found there. Has the author shown, in his account of the work above analyzed, accuracy and care of the same kind that he employs in reporting what happens in the infinitely more difficult field of nature? If not, why not? And if he has—How much are his scientific results worth?

From the literary standpoint the book is one that makes interesting reading, and many of the general ideas are worthy of attention. But such confusion, inaccuracy and misstatements of fact as we have pointed out above are almost or quite sufficient to remove it from the field of science.

H. S. JENNINGS.

MAMMALOGY

Osgood's Revision of the Mice of the Genus *Peromyscus*.—The genus *Peromyscus* is one of the most widely distributed and most numerous represented genera of North American mammals, its range including the whole continent from the Arctic barren-grounds to Costa Rica and Panama. It is, furthermore, one of the most interesting from the viewpoints of morphology and evolution, and also historically, in as much as it typifies and illustrates the progress of North American mammalogy. It includes, as at present restricted, only the small field mice

familiarly known as wood mice, deer mice, vesper mice (in allusion to their semi-nocturnal habits), or white-footed mice (from the fact that nearly all have white feet). They are at home in all sorts of environments, from moist woodlands to the open, semi-arid deserts, and vary in size from an animal smaller than the common house mouse to species nearly the size of a two thirds grown brown rat. The extremes of the group differ widely, not only in general size but in the size of the ears, the relative length of the tail, in coloration, and in dental and cranial characters. They are all subject, each after his kind, to a wide range of color variation, dependent upon age, season and abrasion of the pelage. They are also a plastic group, responding quickly to changes in the environment, so that quite diverse and geographically widely separated forms are often connected by an unbroken chain of intergrades, which renders the satisfactory allocation of closely allied forms extremely difficult, owing largely to the complications that have arisen from the bestowal of names upon what prove to have been intermediate forms. The naming of species and subspecies has been, in most instances, necessarily haphazard, since for a quarter of a century there has been no attempt to coordinate the work of the numerous describers who have raised the number of named forms from about a score in 1885 to fully 200 in 1908.

For several years Mr. Wilfred H. Osgood¹ has been at work upon a monographic revision of the genus, based upon a critical study of over 27,000 specimens, including the available material in all the principal collections, both private and public, in this country, supplemented by the examination of types and other important material in the museums of Europe. "This material," says the author, "includes all the types, both of valid forms and synonyms. In almost all cases in which no types exist, good series of topotypes, or specimens from near the type localities, have been available." The greater part of the specimens examined were collected by the Biological Survey, under the direction of Dr. C. Hart Merriam, with the special purpose of bringing together the material necessary for the proper monographic revision of the group. The results of Mr. Osgood's studies are

¹"A Revision of the Mice of the American Genus *Peromyscus*." By Wilfred H. Osgood, Assistant, Biological Survey. Prepared under the direction of C. Hart Merriam, Chief of Biological Survey. North American Fauna, No. 28. Published April 17, 1909. 8vo, pp. 1-285, pl. i-viii, colored map, and 12 text figures (small distribution maps).

most welcome and will mark an era in the history of the genus, and for a long time to come will be the standard reference work for the group and the point of departure in future investigations.

The first member of the genus to receive a name was the common white-footed mouse of the northeastern United States, called by Kerr in 1792 *Mus agrarius americanus*, renamed *Mus sylvaticus noveboracensis* by Fischer in 1829, both authors regarding it as a variety only of a European species. By 1850 the number of named forms had increased to 9, to which were added 8 during the next decade, of which 13 were formally recognized by Baird in 1857. During the next twenty-five years only two or three new names were added to the list, but from 1885 on to date the number rapidly increased; "no fewer than 167 names for new or supposed new forms of *Peromyscus*," says Osgood, "have been proposed since 1885," to which 14 were added by him in the present paper, making a total of approximately 200 names to be dealt with in the consideration of the group. In the present revision 143 of these names are accepted as representing valid forms, of which 53 are given the rank of species and 90 are treated as subspecies. Of the 53 species, 23 are monotypic and 20 are polytypic, or include one or more subspecies, *P. maniculatus* including 35 forms, *P. leucopus* 12, and so on down to monotypic species. According to the author's own statement (p. 24): "The number of bona fide species scarcely exceeds forty, and of these some half dozen eventually may be reduced in rank."

In early days the white-footed mice, in common with all other mice, were referred to the Linnæan genus *Mus*. Later (1853-1874) they were referred to Waterhouse's untenable genus *Hesperomys*, a name replaced by Coues in 1874 by *Vesperimus* in a subgeneric sense for certain North American species formerly referred to *Hesperomys*, and later (1891) given full generic rank for the group of forms now placed under *Peromyscus*. It was soon discovered, however, that *Vesperimus* was antedated by *Sitomys* Fitzinger (1867), which name had hardly become current before it was found, in 1894, to be antedated by *Peromyscus* Gloger (1841), which bids fair to remain the accepted name for the genus. (This case is thus fully cited as an illustration of the vicissitudes of generic nomenclature in the attempt to secure permanency of names through the necessary application of the rule of priority.)

As already noted, while the group is a compact one, through the close interrelation of all the forms referred to it, the extremes of differentiation are widely diverse, but there are no trenchant lines of division, for, "if a single character becomes pronounced, it is merely an extreme development which may be traced back by stages to a widely different condition." Mr. Osgood, however, considers it desirable to recognize six divisions as subgenera, in order to indicate clearly the relationships of the diverse forms included in the genus. Two of them (*Podomys* and *Ochrotomys*) are here for the first time characterized; two others (*Baiomys* and *Megadontomys*) have been accorded by some authors the rank of genera, mainly as a matter of convenience in dealing with so large a group.

It would require too much space to go into details respecting Mr. Osgood's methods of dealing with the specially difficult cases, but the general outcome of his researches is of such general interest and has such a wide bearing that it seems desirable to give a few passages from his general introduction in his own words. Thus, under the heading "Variation" (p. 16), he says:

Among western forms, variations of such an extremely local and sporadic nature often occur that one may almost believe them to have been produced in one or at most a very few generations. Such variations, of course, are slight, and doubtless produced immediately upon contact with certain conditions. Thus if the range of a given form includes a few square miles of lava beds, specimens from that area show an appreciably darker color than the normal form occupying the surrounding region. And whenever similar conditions are repeated elsewhere, even on a small scale, the same result seems to follow. Again, specimens from the bottom of a dark wooded canyon may be noticeably darker than those from an open hillside only a few hundred yards away. In the absence of absolute proof one can scarcely avoid the suspicion that if the progeny of paler individuals were transferred at an early age to the habitat of darker ones, they would, quite regardless of inherent tendencies, develop a darker color, or, similarly, a lighter color if the process were reversed.

Local and geographic variations are great, so great indeed that, excepting a few species of very limited range, all the species have developed geographic peculiarities by means of which they have been subdivided into more or less numerous (geographic) races or subspecies. One species, *P. maniculatus*, which in its various forms ranges from sea to sea and from the Arctic Circle to the Isthmus of Tehuantepec, remains constant only where conditions are practically identical; hence it is represented by a definable subspecies in almost every faunal area which it enters. The readiness with which local variation is induced

and established appears also from the large number [22] of distinguishable insular forms. Much of the local variation, however, can not be considered subspecific. Certain forms, although preserving the same general characters throughout a definite range, nevertheless show slight and sometimes unique variations in nearly every local series from within the range. In these cases, where no two series of specimens from respective localities are exactly alike, and where no two can be associated except upon the basis of characters common to all, it is necessary to disregard slight variations and treat the entire association under one name.

Under "Intergradation" (p. 17) he continues:

Until recent years continuous and perfect intergradation was demonstrable only in relatively few cases. And even now, although proven beyond doubt in group after group, in many cases it is merely taken for granted. That intergradation exists even more widely than is generally supposed appears from the study of groups in which material is abundant. Of *Peromyscus* we have more complete series than of any other genus of American mammals; that is, not only are there more specimens, but many more localities are represented and the gaps in known distribution are usually few. Barriers impassable to many other mammals have little effect on these mice, for they range continuously, although not always without undergoing change, from sea level to great altitudes, and from the very humid to the very arid regions. Moreover, since usually they are so abundant and easily obtained, representatives are available from nearly every locality in North America ever visited by a mammal collector.² Within the range of one species (*maniculatus*) it is probable that a line, or several lines, could be drawn from Labrador to Alaska and thence to southern Mexico throughout which not a single square mile is not inhabited by some form of this species. They are wanting in the extreme north, but there is scarcely a corner south of the Arctic Circle in which they do not occur. With such wide and continuous distribution perfect intergradation must take place between related forms of different faunal areas, and with such complete collections this intergradation must be plainly evident in nearly all cases.

Classification becomes, then, as has been said,³ like dividing the spectrum and depends largely upon the standards set, for, theoretically at least, the possibilities of subdivision are unlimited. It is not strange, therefore, that hundreds and even thousands of specimens are intergrades almost equally resembling two or more adjacent forms. Many

² American collectors of wide experience, in comparing notes, regard as worthy of remark the few occasions on which they have found themselves in localities where they "couldn't catch *Peromyscus*," and in such places, as a rule, they were also unable to catch anything else.

³ Ridgway, "Birds North and Middle America," Pt. I, p. x, 1901.

of these intergrades for convenience may be referred with some degree of assurance to the form they most closely resemble, but many specimens fall so near the imaginary line between two or more subspecies that it is practically impossible to classify them other than as intergrades. A particularly troublesome class is one which approximates the color of one form and the cranial characters of another, thus reducing the question to one of relative importance of characters.

In view of the foregoing it is evident that taxonomic difficulties can easily arise, not only in this but in many other large groups of conspecific forms, through the unconscious, and hence unavoidable, bestowal of names upon intermediate and unrepresentative variants—upon connecting links between types that reach their full development at some more or less distant point from the locality which happened to be represented by the early describer's limited material. While his act may have been justifiable at the time from the circumstances of the case—absolute ignorance, due to lack of material then nonexistent in collections, of the range and variants of the group as a whole—it has resulted in difficulties of synonymy and procedure that must forever involve the subject, and introduce the element of personal equation into their settlement. As said by Osgood,

The reviser is often confronted with three names representing steps in development, . . . one of the designated forms being intermediate between the other two. If, as often occurs, the recognition of only two forms seems necessary, and the intermediate has been named before either of the extremes, its name, having priority, must stand, and it becomes necessary to decide which of the names representing the extremes shall be considered a synonym. . . . A reviser in dealing with such names is compelled first to determine the number of recognizable forms without regard to names.

The type specimens are then referred, according to their resemblance, to the recognizable forms, and the names of the forms determined by the rule of priority.

Another difficulty is the temperamental, the viewpoints of different authors as to what degree of differentiation entitles forms to recognition. In the main Mr. Osgood has taken what appeals to the present writer as a judicial course, and has threaded his way with good judgment through the maze of difficulties inseparable from his subject. At all events he has methodized and correlated our present knowledge of the group, and clearly presented the relationships of the scores of minor forms that compose it. For the present at least it may be accepted and honored

as the last word, but of course not as the final adjustment, which must come slowly, as new material is gathered from the lesser known areas of the range of the genus, especially from the region south of the United States.

His paper is accompanied by a key to the species, and also by keys to the subspecies where such are required. A colored map shows the distribution of the species and subspecies of the *Peromyscus maniculatus* group, with indication of the intergrading areas between the recognized forms. The twelve text figures consist of small maps showing the range of all of the other species and subspecies. There are also tables giving the average and extreme external and cranial measurements of series of specimens of each form. Seven of the eight plates illustrate the skulls of some fifty or more species and subspecies (from photographs), while plate eight gives enlarged figures of the teeth and soles of the several subgenera.

It is to be regretted that the bibliographical references are restricted to the citation of synonyms, and thus fail to give clues to the work of previous authors, so essential to subsequent investigators in following up the history of a species or group, and hence of high importance in monographic treatises like the present. Aside from the convenience such references afford, they are important as a means of coordinating definitely, from the monographer's standpoint, the work of previous authors. Furthermore, in the lists of "specimens examined," only the localities and number of specimens from each are mentioned, the name of the collector and the collection where the specimens are located being omitted, thus giving no clue to the particular specimens to which the monographer refers. This, however, is obviously due to a faulty system of treatment rather than to the preference of the author, since the same method characterizes the long list of important monographs issued under the auspices of the Biological Survey. The addition of these essential items of information would considerably increase the amount of text, and for this reason have perhaps been omitted, since it is known that, for a long time at least, the restriction placed by the officials "higher up" in the Department of Agriculture on the technical publications of the Biological Survey were practically prohibitive of monographic papers exceeding a certain number of pages.

J. A. ALLEN.